

Application No. 10/730,720
Amendment dated December 21, 2004
Reply to Office Action of September 21, 2004

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Claims 1-50 (canceled)

Claim 51 (new) An improved method of increasing combustion of a hydrocarbon fuel in a combustion chamber of a furnace using only air as an oxidant, comprising introducing part of the air into the combustion chamber near one or more fuel burners where it is combusted with the hydrocarbon fuel thereby creating a flue gas, and introducing a remaining portion of air into the combustion chamber at a first velocity at a plurality of locations downstream of the fuel burners where it is combusted with the flue gas, the improvement comprising:

a) injecting oxygen-enriched gas in substitution for the remaining portion of air through a plurality of lances into the flue gas at the plurality of downstream locations, the oxygen-enriched gas having an oxygen concentration of no more than 2% greater than that of air, the second velocity being greater than the first velocity.

Claim 52 (new) The improved method of claim 51, wherein the second velocity is in the range of 0.75 Mach up to about 5 Mach.

Claim 53 (new) The improved method of claim 51, wherein the combustion chamber has four walls and each of the plurality of lances projects from one of the walls at an angle with respect to that wall in a range of from 20° to 160°.

Claim 54 (new) The improved method of claim 51, wherein:

a) the combustion chamber has four walls;

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- b) the combustion chamber has a length, width or height of L_{CH} ;
- c) each of the plurality of lances on one of the walls is separated by a distance L_L ; and
- d) $L_L < L_{CH} / 2$.

Claim 55 (new) The improved method of claim 54, wherein:

- a) half of the plurality of lances are disposed on a first wall of the combustion chamber;
- b) half of the plurality of lances are disposed on a second wall opposing the first wall;
- c) the lances on the first wall are positioned a distance l from the lances on the second wall, wherein $0 < l < L_L / 2$, wherein L_L is the distance between lances on said first wall.

Claim 56 (new) An improved method of increasing combustion of a hydrocarbon fuel in a combustion chamber of a furnace using only air as an oxidant, comprising introducing part of the air into the combustion chamber near one or more fuel burners where it is combusted with the hydrocarbon fuel thereby creating a flue gas, and introducing a remaining portion of air into the combustion chamber at a first velocity at a plurality of locations downstream of the fuel burners where it is combusted with the flue gas, the improvement comprising:

- a) reducing the remaining portion of air introduced into the flue gas at the plurality of locations; and
- b) injecting oxygen-enriched gas into the reduced remaining portion of air through a plurality of lances into the flue gas at the plurality of downstream locations, the oxygen-enriched gas being injected in an amount at a second velocity sufficient to provide an oxygen concentration in the combined flue gas, reduced remaining portion of air, and oxygen enriched gas of no more than 2% greater than that of air, the second velocity being greater than the first velocity.

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Claim 57 (new) The improved method of claim 56, wherein the second velocity is in the range of 0.75 Mach up to about 5 Mach.

Claim 58 (new) The improved method of claim 56, wherein the combustion chamber has four walls and each of the plurality of lances projects from one of the walls at an angle with respect to that wall in a range of from 20° to 160°.

Claim 59 (new) The improved method of claim 56, wherein:

- a) the combustion chamber has four walls;
- b) the combustion chamber has a length, width or height of L_{CH} ;
- c) each of the plurality of lances on one of the walls is separated by a distance L_L ; and
- d) $L_L < L_{CH} / 2$.

Claim 60 (new) The improved method of claim 59, wherein:

- a) half of the plurality of lances are disposed on a first wall of the combustion chamber;
- b) half of the plurality of lances are disposed on a second wall opposing the first wall;
- c) the lances on the first wall are positioned a distance l from the lances on the second wall, wherein $0 < l < L_L / 2$, wherein L_L is the distance between lances on said first wall.

Claim 61 (new) The improved method of claim 51, wherein the hydrocarbon fuel is pulverized coal.

Claim 62 (new) The improved method of claim 56, wherein the hydrocarbon fuel is pulverized coal.

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Claim 63 (new) An improved method of increasing combustion of a first hydrocarbon fuel in a combustion chamber of a furnace using only air as an oxidant, comprising introducing part of the air into the combustion chamber near one or more fuel burners where it is combusted with the hydrocarbon fuel thereby creating a flue gas, and introducing a remaining portion of air into the combustion chamber at a first velocity at a plurality of locations downstream of the fuel burners where it is combusted with the flue gas, the improvement comprising:

a) combusting a portion of an oxygen enriched gas with a second hydrocarbon fuel at the plurality of locations thereby creating a flame at each of the plurality of locations, the oxygen enriched gas having an oxygen concentration of no more than 2% greater than that of air; and

b) injecting another portion of oxygen enriched gas into each of the flames through associated lances each of which is centrally located with respect to the associated flames, wherein the first and second hydrocarbon fuels are the same or different.

Claim 64 (new) The improved method of claim 63, wherein the second velocity is in the range of 0.75 Mach up to about 5 Mach.

Claim 65 (new) The improved method of claim 63, wherein the combustion chamber has four walls and each of the plurality of lances projects from one of the walls at an angle with respect to that wall in a range of from 20° to 160°.

Claim 66 (new) The improved method of claim 63, wherein:

- a) the combustion chamber has four walls;
- b) the combustion chamber has a length, width or height of L_{CH} ;
- c) each of the plurality of lances on one of the walls is separated by a distance L_L ; and

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d) $L_L < L_{CH} / 2$.

Claim 67 (new) The improved method of claim 66, wherein:

- a) half of the plurality of lances are disposed on a first wall of the combustion chamber;
- b) half of the plurality of lances are disposed on a second wall opposing the first wall;
- c) the lances on the first wall are positioned a distance l from the lances on the second wall, wherein $0 < l < L_L / 2$, wherein L_L is the distance between lances on said first wall.

Claim 68 (new) The improved method of claim 63, wherein the first hydrocarbon fuel is pulverized coal.

Claim 69 (new) The improved method of claim 51, wherein the hydrocarbon fuel is natural gas.

Claim 70 (new) The improved method of claim 51, wherein the hydrocarbon fuel is fuel oil.

Claim 71 (new) The improved method of claim 56, wherein the hydrocarbon fuel is natural gas.

Claim 72 (new) The improved method of claim 56, wherein the hydrocarbon fuel is fuel oil.

Claim 73 (new) The improved method of claim 63, wherein the first hydrocarbon fuel is natural gas.

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Claim 74 (new) The improved method of claim 63, wherein the first hydrocarbon fuel is fuel oil.